

**SPECIFICATIONS FOR
DRILLING AND MONITORING WELL INSTALLATION
ALBION-SHERIDAN TOWNSHIP LANDFILL
ALBION, MICHIGAN**

Prepared for

**U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
CHICAGO, ILLINOIS**

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SECTION 01010SUMMARY OF WORKPART 1 - GENERAL

1.01 SITE LOCATION AND DESCRIPTION:

The Albion-Sheridan Township Landfill site (the "site") is a former landfill located approximately 1 mile east of Albion, Michigan in Section 36 (T2S, R4W) of Calhoun County (see Figure 1). The site is defined as Lot 27 and Lot 28 of the Supervisor's Plat. The site is comprised of approximately 30 acres of land. It is bordered on the north by Michigan Avenue (also known as State Route 99), on the east by the Calhoun/Jackson County line, and on the south by East Erie Road. The western boundary of the site is approximately 660 feet west of the Calhoun/Jackson County line. The site is located in a predominantly rural-residential and commercial area on the east side of Calhoun County.

1.02 BACKGROUND

The Albion-Sheridan Township Landfill was privately owned and was operated between 1966 and 1981. The landfill reportedly accepted municipal refuse and industrial wastes from the City of Albion and nearby Sheridan Township. In the early 1970s, the MDNR approved the landfill to accept metal plating sludges described as insoluble hydroxides and carbonates. The exact volume of metallic sludges received by the landfill is unknown, but it has been estimated that as much as 6,000 cubic yards of sludge were accepted. Other materials, such as paint wastes and thinners, oil and grease, and dust, sand, and dirt containing fly ash and casting sand are also believed to have been disposed of at the site. Near the time the landfill closed, Scott's Disposal Service, Inc. purchased some land in the northern part of the site to use as a waste transfer station.

1.03 GEOLOGIC AND SUBSURFACE CONDITIONS

A. Subsurface Features/Local Water Supply

Soils at the site are reported to be predominantly glacial sands and gravels. Discontinuous clay, or silty clay, layers may be interbedded within the coarser materials and may also directly overlie the bedrock surface. The approximate thickness of the unconsolidated glacial deposits is anticipated to range between 25 and 40 feet at the site. In 1980, the water table was encountered approximately 12 to 26 feet below ground level in 3 on-site monitoring wells, within the unconsolidated soils.

The bedrock beneath the site is comprised of Mississippian-aged sandstones of the Marshall Formation. These sandstones serve as the primary aquifer for private, public, and industrial water supply in the area. The 2 aquifers (unconsolidated soils and the sandstone) are believed to be hydraulically

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connected with ground water flowing in a south to southwesterly direction towards the North Branch of the Kalamazoo River.

Based on 1980 census figures, it was estimated that 13,500 people received water from public or private wells within a 3-mile radius of the site. A private well was located in the southern portion of the site to provide water to a residence once occupied by the landfill operator. This 108 foot deep well was completed in bedrock. A sample collected from this well in October 1989 was analyzed for volatile organic compounds (VOCs), none were detected.

Two wells used for water supply for the Amberton Village Subdivision, are located approximately 1000 feet east of the site. Both of these bedrock wells were drilled to a depth of 350 feet and are cased to a depth of 95 feet.

Three of Albion's municipal wells are located approximately 1 mile west of the site. These wells are completed in the Marshall Sandstone at depths ranging from 254 to 260 feet. Casing extends 76 feet below ground in 2 of the wells, and 58 feet below ground level in the third.

1.04 GENERAL DESCRIPTION OF WORK**A. Pre-bid Meeting:**

A pre-bid meeting will be held at the Sheridan Township Administration Building to be followed by a visit to the Albion-Sheridan Township Landfill site on July 9, 1992. Details of the pre-bid meeting are explained in ARTICLE 8 of the INSTRUCTIONS TO BIDDERS. Questions regarding the specifications will be addressed at the pre-bid meeting by the PRIME CONTRACTOR's representative. The site will be open for inspection of well locations and general access during this meeting. Attendance at this meeting and site visit is required by all BIDDERS.

B. Subsurface Soil and Landfill Refuse Sampling

Soil samples will be collected at each of the ground water monitoring well cluster locations (15 total). In order to characterize the composition of the landfill, samples from within the landfill will also be collected. It is anticipated that 3 borings will be drilled within the landfill. The general anticipated location for monitoring well clusters is shown in Figure 2. All soil samples will be collected from borings drilled to accommodate the installation of monitoring wells.

Soil boring and landfill refuse samples will be collected by the SUBCONTRACTOR through hollow-stem augers with a 2-foot long, 3-inch diameter split-spoon sampler.

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Split-spoon samples will be collected continuously from the existing ground surface to the top of bedrock at 6 of the soil boring locations, (MW-1 through MW-6) and in each of the landfill refuse borings (LF-1 through LF-3). In the deepest borehole at each of the remaining ground water monitoring well cluster locations, split-spoon samples will be collected at 2.5-foot intervals in the first 10 feet and thereafter at 5-foot intervals to the bottom of the borehole.

The PRIME CONTRACTOR may request that the SUBCONTRACTOR collect additional soil samples with 3-inch diameter split-spoon samplers in adjacent borings at selected monitoring well cluster locations. For bidding purposes it is assumed that 45 additional soil samples will be collected.

If a clay-rich layer that is greater than 2 feet thick is encountered while drilling, a Shelby tube sample of the clay will be collected by the SUBCONTRACTOR. It is anticipated that 20 Shelby tube samples will be collected.

C. Installation of Monitoring Wells - Phase I

A maximum of 40 monitoring wells will be installed at up to 18 tentative locations during Phase I of this RI (see Figure 2). At some of the locations it is possible that no wells will be installed. The ultimate determination of the number of wells required to define ground water flow and quality characteristics will be determined by the PRIME CONTRACTOR. A flow chart for the general criteria used to determine the number of bedrock monitoring wells installed during Phase I is provided in Figure 3. The number of monitoring wells installed in the glacial deposits will be dependent on the number of locations at which bedrock wells are installed and the thickness of the glacial aquifer. It is anticipated that 1 well at each location will be screened immediately below the top of the water table. Other wells may be installed immediately above the bedrock and/or in the bedrock.

Initially, the bedrock wells at 5 locations (MW-1 through MW-5) will be installed. Based on the calculated ground water flow direction resulting from measurements made in these 5 wells by the PRIME CONTRACTOR, the deep bedrock well at MW-6 will be installed directly downgradient from the site.

All monitoring wells will be constructed of 2-inch diameter PVC riser pipe and screens with flush joint threads. Threaded joints between sections of casing will be wrapped with Teflon tape to eliminate leakage at the threads. The screens will have 0.010-inch (10-slot) factory prepared openings. A threaded PVC cap will be installed on the bottom of each well screen. Prior to

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installation of each well, all well construction materials will be steam cleaned to the satisfaction of the PRIME CONTRACTOR.

A sand pack of clean silica sand approved by the PRIME CONTRACTOR shall be placed in the screened interval and extend to at least 2 feet and not more than 3 feet above the top of the well screen.

A 2 to 3-foot thick seal of pelletized bentonite will be emplaced immediately above the top of the sand pack to ensure that a competent seal is in place.

A cement/bentonite grout will be tremied from the bentonite seal to just below ground surface to ensure that the annular space between the well and borehole has been completely sealed.

A threaded, vented PVC cap will be installed on the top of the casing riser.

A locking, anodized aluminum protective casing will be installed at the ground surface secured in concrete.

Steel bumper posts may be installed surrounding any well that appears to be in a traffic zone. For bidding purposes it is assumed that 4 bumper posts will be needed at 10 locations for a total of 40 posts.

A schematic diagram of construction details for monitoring wells in glacial deposits and monitoring wells in bedrock is shown in Figures 4 and 5, respectively.

All drilling and well installation will be supervised and documented by the PRIME CONTRACTOR. A summary of Phase I monitoring wells is provided in Table 1.

D. Monitoring Wells in Glacial Deposits

One monitoring well will be installed by the PRIME CONTRACTOR at each of the 4 locations (MW-10 through MW-13) in the wetlands along the North Branch of the Kalamazoo River. Each of these wells will have a 3-foot long screen which will be installed approximately 2 feet below the water table. All materials for these 4 wells will be supplied to the PRIME CONTRACTOR by the SUBCONTRACTOR.

Monitoring wells installed in the glacial deposits by the SUBCONTRACTOR shall be installed through hollow-stem augers. The inside diameter (ID) of the hollow-stem augers will be 4.25 inches. Except at the wetland locations discussed above, it is anticipated that 2 monitoring wells with 5-foot long screens will be installed in the glacial deposits at each location shown in

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Figure 2 during Phase I. One monitoring well will be installed with the top of the screen set approximately 2 feet below the water table, and 1 will be installed with the base of the screen immediately above the top of bedrock.

E. Monitoring Wells in Bedrock

The top of the screen in all bedrock wells installed during Phase I, except the deep well at the downgradient location (MW-6), will be installed approximately 10 feet below the top of the unweathered bedrock. The screens in all bedrock wells will be 5 feet long. The screen in the deep bedrock well at the downgradient location (MW-6) will be set in the second 10-foot interval of bedrock in which no evidence of contamination is observed or 120 feet below ground surface, whichever is shallower. For bidding purposes it is assumed the deep well at MW-6 will be installed 120 feet below the ground surface.

The glacial materials at each bedrock well will be cased with 6-inch diameter Schedule 80 PVC set through 8.25-inch ID (or larger, if approved by the PRIME CONTRACTOR) hollow-stem augers. The casing will extend 2 feet below the base of the unweathered bedrock. A K-packer will be installed on the bottom of the casing to aid in sealing the annular space between the casing and the borehole with a cement/bentonite grout. The cement/bentonite grout will be allowed to set for a minimum of 24 hours before drilling activities resume. For bidding purposes it should be assumed that no standby-time will be awarded while the grout is setting. It is expected that the driller will move to another location while the grout is setting.

At the first 6 bedrock locations drilled, the bedrock will be cored using air rotary drilling techniques. Cores will initially be collected at 5-foot intervals. Coring intervals may be increased to 10 feet if core recovery is consistently greater than 95 percent and if approved by the PRIME CONTRACTOR.

Upon completion of coring, the boreholes will be reamed to approximately 5 inches in diameter then flushed with water to clean the borehole prior to installing the well. Air rotary techniques will be used to drill the 5-inch diameter boreholes for each of the remaining bedrock wells. Two-inch diameter PVC wells will then be installed in each borehole.

F. Leachate Monitoring Wells

If the water table is encountered before the base of the landfill refuse, a monitoring well may be installed to collect a representative sample of the landfill leachate. For bidding purposes it is assumed that a monitoring well will be installed in each landfill refuse boring (3 wells total).

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Leachate monitoring wells will be constructed of 2-inch diameter PVC and the base of the well screen will be installed at the base of the landfill refuse. The screen in each leachate monitoring well will be 10-feet long and have 0.010-inch (10 slot) openings.

G. Vertical Ground Water Sampling

Ground water samples will be collected at 5-foot intervals while drilling through glacial deposits at 3 locations during Phase I (MW-3, MW-4, and MW-6). Sampling will be accomplished with temporary, 5-foot long, 2-inch PVC monitoring wells set through the 8.25 ID hollow-stem augers while drilling in preparation for installation of the 6-inch casing. The borehole will be drilled to the depth targeted for the bottom of the well screen, then the screen will be lowered to the bottom of the borehole. The augers will then be raised so that the bottom of the lead auger is approximately 2 feet above the top of the well screen. One temporary well will be dedicated to each well location.

Ground water samples will be collected during coring of the deep bedrock well at the downgradient location (MW-6) during Phase I. Samples will be collected for each 10-foot interval cored. After each 10-foot interval of rock has been cored, a temporary 5-foot long 2-inch diameter PVC well screen with PVC riser will be isolated in that section of bedrock by the SUBCONTRACTOR using a packer at the top of the screen.

The SUBCONTRACTOR will purge at least 3 volumes from each temporary well prior to sample collection by the PRIME CONTRACTOR. The PRIME CONTRACTOR will determine when purging is complete. For bidding purposes it is assumed that 8 intervals will be sampled in the bedrock and a total of 8 intervals will be sampled in the glacial deposits. It is also assumed that 1 hour of time will be required to purge each temporary well (16 hours total) prior to sampling.

H. Aquifer Tests

In situ hydraulic conductivity tests (packer tests) will be performed in the bedrock corehole at the downgradient monitoring well location (MW-6). The packer tests will be performed by the SUBCONTRACTOR on the entire cored interval in accordance with methods described in Test Designation E-18 of the Earth Manual (Bureau of Reclamation, 1974).

The packer tests will be performed in 10-foot intervals from the bottom of the borehole to the top of bedrock. If the hydraulic conductivity within a test interval is too high to obtain meaningful data, the test may be rerun in that zone in 5-foot intervals.

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For bidding purposes, it is assumed that a total of 11 intervals will be tested (nine 10-foot intervals and two 5-foot intervals) and setup and testing will require 8 hours.

I. Monitoring Well Development

All of the newly installed monitoring wells will be developed by the SUBCONTRACTOR no earlier than 24 hours after installation. Well development will be performed by surging and pumping water back and forth through the well screen. The wells will be developed to the satisfaction of the PRIME CONTRACTOR. Purged water will be collected in 55-gallon drums, provided by the SUBCONTRACTOR. The drums will be transported and emptied into a larger purge water collection tank in the support area by the SUBCONTRACTOR. The PRIME CONTRACTOR will supply the purge water tank and the SUBCONTRACTOR will provide purge water collection drums. The ultimate disposal of the water will be the responsibility of the PRIME CONTRACTOR.

J. Boring/Well Abandonment

No borings or wells are anticipated to require abandonment. If necessary, well abandonment will be accomplished by cutting the casing off at ground level and filling the well with a cement/bentonite grout from the bottom up using a tremie pipe. Any boring requiring abandonment will be grouted from the bottom of the borehole to the ground surface with a cement/bentonite grout placed through a tremie pipe.

Well and boring abandonment will be performed by the SUBCONTRACTOR as directed by the PRIME CONTRACTOR. For bidding purposes it is assumed that a total of 100 feet of boreholes and 80 feet of wells will require abandonment during this project.

K. Decontamination

All drilling and split-spoon sampling equipment will be decontaminated between samples and sampling locations by the SUBCONTRACTOR to the satisfaction of the PRIME CONTRACTOR. At a minimum, the SUBCONTRACTOR will have a 3-person work crew for each drill rig in order to ensure that timely decontamination can be performed during drilling operations. The SUBCONTRACTOR will provide a steam cleaner for decontamination procedures. Electric power is available on-site. If available on-site electric (120 volts, 20 amps) is insufficient for steam cleaning purposes, it will be the responsibility of the SUBCONTRACTOR to provide a suitable generator.

SECTION 01010SUMMARY OF WORK**L. Drilling Location Access**

The SUBCONTRACTOR must visit the site during the pre-bid meeting and site visit, prior to submitting the bid, to ensure proper consideration of mobilization between boring locations.

M. Installation of Monitoring Wells - Phase II

It is possible that additional ground water monitoring wells will be installed during a second phase of drilling (Phase II) for this investigation. It is anticipated at this time that 12 additional wells (5 in the deep glacial materials, 5 in the shallow bedrock, and 2 in the deep bedrock) will be installed at locations to be selected based on results of the Phase I investigation and shall be installed according to the methods and specifications described herein. For bidding purposes it should be assumed that no sampling of subsurface materials will be required during the installation of these wells; however, if the PRIME CONTRACTOR requests that samples be collected, these additional samples will be collected at the unit costs submitted for Phase I.

A summary of monitoring wells installed during Phase II is provided in Table 2.

1.05 PERSONAL PROTECTIVE EQUIPMENT AND SAFETY TRAINING:

- A.** The PRIME CONTRACTOR will provide the SUBCONTRACTOR with a copy of the Site Health and Safety Plan (provided under separate cover). SUBCONTRACTORS shall comply with the Site Health and Safety Plan as required by the PRIME CONTRACTOR. The PRIME CONTRACTOR may issue a stop work order to the SUBCONTRACTOR for failure of its employees to comply with the Site Health and Safety Plan. The SUBCONTRACTOR will not be paid for the time occurring after notice of a stop work order and before resumption of work.
- B.** All SUBCONTRACTOR personnel who enter hazardous sites will be required, at a minimum, to have passed an entry physical examination that meets the OSHA requirements for respirator use (29 CFR 1910.134). The SUBCONTRACTOR agrees to submit to the PRIME CONTRACTOR a certification for each employee assigned to hazardous waste site field activities that said employee has been medically certified by a physician for this work, including the use of a respirator in accordance with the provisions of 29 CFR 1910.134. Certifications of employee medical status must be submitted to the PRIME CONTRACTOR before an employee shall be permitted to work at a hazardous waste site under the Subcontract Documents.

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- C. All Subcontract personnel engaged in on-site construction work must provide certification of completion of a 40 hour Health and Safety Training Course in accordance with 29 CFR 1910.120. Training shall include, but not be limited to, use of personal protective equipment (including respirators), decontamination, hazard recognition, safe operating procedures, and emergency response.

1.06 SUBMITTALS:

The following submittals will be used in the evaluation of bids:

- A. A list of major equipment to be used on this job, including age of equipment and model shall be provided to the PRIME CONTRACTOR with the bid submittal.
- B. A brief biography of related experience for each employee of the SUBCONTRACTOR to be actively involved in this work.

1.07 REFERENCES:

- A. Applicable Standards:
1. For Rigid PVC Compounds and PVC Plastic Pipe: American Society of Testing Materials (ASTM) D1784 and D1785, respectively.
 2. For Soil Investigation and Sampling for Auger Borings: ASTM D1452.
 3. For Split-Spoon Sampling: ASTM D1586.
 4. For Packer Testing: U.S. Department of the Interior, 1974. Earth Manual, Bureau of Reclamation, U.S. Government Printing Office, Washington, DC

1.08 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The methods of measurement and basis for payment for work performed by the SUBCONTRACTOR will be in accordance with units and prices submitted in the Unit Price and Lump Sum Bid Form.

1.09 JOB CONDITIONS:

- A. Cap each well when unattended.

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- B. Cleanup shall promptly follow well installation.
- C. Work shall be performed according to safety precautions described in the Health and Safety Plan (see attached Health and Safety Plan).
- D. All equipment shall arrive on-site in good working order and be kept in good working order throughout the duration of the project.
- E. Drilling and sampling equipment shall be steam-cleaned prior to arrival on-site, upon arrival at the site, between wells, and prior to leaving the site. Decontamination will be performed at the specified decontamination area provided by the PRIME CONTRACTOR (see Figure 6).
- F. Sampling equipment shall be decontaminated by the SUBCONTRACTOR to satisfaction of the PRIME CONTRACTOR.
- G. Water for drilling and decontamination is not available on-site. The PRIME CONTRACTOR shall locate an acceptable water source within 2 1/2 miles of the site. The SUBCONTRACTOR shall be responsible for obtaining and transporting the water.

1.10 FURNISHED PRODUCTS:**A. SUBCONTRACTOR's Responsibilities**

- 1. Designate the delivery date for each product in the Construction Schedule.
- 2. Receive and unload the products at the site.
- 3. Promptly inspect products jointly with the PRIME CONTRACTOR, record shortages, and damaged or defective items.
- 4. Handle products at the site, including uncrating and storage.
- 5. Protect the products from exposure to the elements and from damage.
- 6. Assemble, install, connect, and adjust the products as stipulated in the respective Sections of the Specifications.
- 7. Repair or replace items damaged by the SUBCONTRACTOR.

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B. PRIME CONTRACTOR's Responsibilities:

1. Inspect deliveries jointly with the SUBCONTRACTOR.
2. Provide equipment storage area.

1.11 COORDINATION:

- A. Utilities: The PRIME CONTRACTOR will contact Miss Dig and have the utilities locate their facilities on-site.
- B. Work times shall be as follows, except in an emergency:
 1. Work will be conducted for approximately 50 hours each week. Under normal conditions this will consist of five (5) 10-hour days, Monday through Friday each week. Saturday work will only be included if directed by the PRIME CONTRACTOR.
 2. Night work, from sunset to sunrise, will not be permitted.
- C. The SUBCONTRACTOR may use more than 1 drilling rig at a time as authorized by the PRIME CONTRACTOR.
- D. When inspection readiness is declared by the SUBCONTRACTOR and the inspection proves unsuccessful, all costs for the inspection shall be borne by the SUBCONTRACTOR.

1.12 CUTTING AND PATCHING:

- A. SUBCONTRACTOR shall be responsible for all cutting, fitting, and patching required to complete the work or to:
 1. Make its several parts fit together properly.
 2. Remove and replace defective work.
- B. Any cutting, patching, or altering of the work, or any part of it, by the SUBCONTRACTOR, shall not endanger the work.
- C. The cost for ill-timed, rejected or non-work shall be borne by the party responsible for completing said work.

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PART 2 - PRODUCTS AND MATERIALS

2.01 CASING:

- A. All well casing will be flush-joint, 2-inch ID, Schedule 40 PVC. The casing joints will be factory-threaded and will be wrapped with teflon tape. No solvents, cements, or adhesive tapes may be used to join sections of pipe.
- B. During the installation of the bedrock wells, a 6-inch ID, flush-joint, Schedule 80 PVC casing will be grouted in place prior to coring or drilling the bedrock. The casing will extend from 2 feet below the top of competent bedrock to the ground surface. A neoprene packer will be utilized above the top of the screen to isolate the interval to be sampled. The casing joints will be factory-threaded. No solvents, cements, or adhesive tapes may be used to join sections of pipe.

2.02 SCREEN:

- A. All screens will consist of factory-threaded, flush-joint, 2-inch ID, Schedule 40 PVC pipe with factory-machined slots.
- B. Slot openings in the screen will be 0.010 inches (10-slot).
- C. A flush-thread cap of the same material as the screen shall be installed on the base of each screen.

2.03 PROTECTIVE CASING:

- A. The outer protective casing will be constructed of anodized aluminum and at least 4 inches in diameter. The protective casing shall have a hinged locking cap.
- B. For all wells, install the protective casing centered around the riser pipe. The protective casing shall extend at least 3.5 feet below the ground surface and to a few inches above the top of the riser pipe.
- C. A 1/4-inch diameter drainage hole will be drilled in the protective casing approximately 6 inches above the top of the concrete pad.
- D. The protective casing shall be steam cleaned by the SUBCONTRACTOR prior to installation.

SECTION 01010SUMMARY OF WORK**2.04 WELL CAPS:**

Two-inch diameter, threaded and vented caps constructed of Schedule 40 PVC shall be used to cap each well.

2.05 LOCKS:

The locks shall be No. 1 Master locks or equivalent and shall be keyed alike.

2.06 GRAVEL PACK:

The gravel pack shall be comprised of a medium-grained silica sand approved by the PRIME CONTRACTOR.

2.07 BENTONITE SEAL:

The bentonite required for the seal of the wells shall be in pellet form.

2.08 CEMENT/BENTONITE GROUT

The cement/bentonite grout will consist of Portland cement (must conform to ASTM C150, Type I or II) and powdered bentonite. The cement/bentonite grout shall be composed of not more than 6 gallons of water per bag (94 pounds) of cement; 3 to 4 pounds of powdered bentonite per bag of cement will be added to reduce shrinkage. The grout shall be mixed to the satisfaction of the PRIME CONTRACTOR prior to placement in the annular space.

2.09 DRUMS:

55-gallon steel drums approved by the U.S. Department of Transportation shall be provided by the SUBCONTRACTOR, for the use of the SUBCONTRACTOR to collect and transport soil cuttings and purge water to the support area.

PART 3 - EXECUTION**3.01 INSTALLATION:**

- A. Soil and landfill refuse samples will be collected with a 3-inch diameter split-spoon sampler. Soil and landfill refuse samples will be collected continuously or at depths of 2.5, 5, 7.5, and 10 feet, and at 5 foot intervals thereafter as indicated in Table 1. Split-spoon sampling equipment will be decontaminated by the SUBCONTRACTOR between samples and sample locations to the satisfaction of the PRIME CONTRACTOR. The SUBCONTRACTOR shall

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provide clean jars with lids for samples collected for lithologic and refuse descriptions.

- B. Compressed air used for air coring or rotary drilling shall be filtered to prevent the introduction of water, oils, and/or any other foreign substance, downhole, and into the subsurface. Inspection ports shall be provided so that the effectiveness of the air filtration system can be routinely reviewed by the PRIME CONTRACTOR.
- C. Bedrock coring equipment shall be NX size with a split inner core barrel. Hinged, wooden boxes for storing the bedrock core samples shall be supplied by the SUBCONTRACTOR.
- D. The introduction of water into the borehole during drilling or sampling will be minimized. Water for such purposes will be obtained from the approved source and approval of the PRIME CONTRACTOR will be obtained prior to use.
- E. Packer testing equipment shall be provided by, and set up by, the SUBCONTRACTOR as indicated in Figure 7. Testing equipment shall include the following:
 - 1. Pneumatic type packers, each with a length at least 5 times greater than the diameter of the borehole, will be utilized to isolate the test interval.
 - 2. 1 1/4-inch outer diameter pipe shall be utilized for pumping water into the test section. Any swivels and other fittings required shall have a uniform diameter. The use of fittings shall be minimized.
 - 3. The flow meters and pressure gauges utilized for packer testing shall be calibrated prior to use at the site. Documentation of calibration shall be provided to the PRIME CONTRACTOR prior to commencement of the tests.
 - 4. The pressure gauge shall be marked in 1 pound per square inch (PSI) increments.
 - 5. A 1-inch disk type meter shall be used to measure water flows between 1 and 50 gpm. A 4-inch propeller or impeller type meter shall be used to measure flows between 50 and 350 gpm. Each water meter utilized for packer testing shall be equipped with an instantaneous flow meter and a totalizer.

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6. Nitrogen gas shall be used to inflate the packers. The gas supply tank shall be equipped with a pressure regulator, cylinder pressure gauge, and packer pressure gauge.
 7. Water to be used for the packer tests shall be from the approved source and will be free of sediments.
 8. The pump utilized for packer testing shall be of the centrifugal type to minimize pressure fluctuations.
- F. All PVC well materials and casing protectors will be steam cleaned to the PRIME CONTRACTOR's satisfaction before being installed. The SUBCONTRACTOR shall use clean gloves when handling and installing steam cleaned well materials.
- G. A sand pack of clean, medium-grained silica sand shall extend to at least 2 feet and not more than 3 feet above the top of the well screen. A minimum 2-foot bentonite seal shall be installed above the sand pack. A cement/bentonite grout will be used to fill the annular space above the bentonite seal to approximately 1 to 2 feet below the ground surface. A concrete seal shall be placed above the grout to the ground surface to secure the well and the protective casing.
- H. The SUBCONTRACTOR shall develop each well by a method that results in surging water into and out of the screen to the satisfaction of the PRIME CONTRACTOR.
- I. All well cuttings and development water shall be captured and placed in drums provided by the SUBCONTRACTOR. It shall be the responsibility of the SUBCONTRACTOR to containerize the cuttings and development water in 55-gallon drums. The SUBCONTRACTOR shall be responsible for moving the drums from the well site to the support area. Roll-off boxes and large water tanks will be provided by the PRIME CONTRACTOR for temporary storage of soils and purge water at the support area. Ultimate disposal of soils and purge water will be the responsibility of the PRIME CONTRACTOR.
- J. The SUBCONTRACTOR shall decontaminate all drilling and sampling equipment by steam cleaning to the satisfaction of the PRIME CONTRACTOR.

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If the tools have visible oil or dirt that cannot be removed by steam cleaning, they may be sprayed with hexane, allowed to air dry, and steam cleaned again prior to reuse.

Proper handling, storage, and collection of hexane, if used, shall be the responsibility of the SUBCONTRACTOR. The PRIME CONTRACTOR will supply the Hexane and will be responsible for disposal of any Hexane used. To minimize decontamination time, the SUBCONTRACTOR shall provide a minimum of 6 complete sets of split-spoon samplers for each rig to be used for sampling of soil or landfill refuse.

- K. Plugging or abandonment, if necessary, shall require review by the PRIME CONTRACTOR.

Table 1
Phase I Monitoring Well Summary
Albion - Sheridan Township Landfill
Albion, Michigan
All Units in Feet

Soil Boring/Well Number	Estimated Depth to Water	Estimated Depth to Base of Screen/Boring	Screen Length	Estimated Length of 2" PVC Casing	Estimated Length of 6" PVC Casing	3" Split-Spoon Sampling (see footnotes)	Continuous Bedrock Coring	Vertical Ground Water Sampling
MW-1-SG	30	37	5	34				
MW-1-DG	30	45	5	42				
MW-1-SB	30	62	5	59	50	C	Yes	
MW-2-SG	25	32	5	29				
MW-2-DG	25	40	5	37				
MW-2-SB	25	57	5	54	45	C	Yes	
MW-3-SG	25	32	5	29				
MW-3-DG	25	40	5	37				Yes
MW-3-SB	25	57	5	54	45	C	Yes	
MW-4-SG	25	32	5	29				
MW-4-DG	25	40	5	37				Yes
MW-4-SB	25	57	5	54	45	C	Yes	
MW-5-SG	25	32	5	29				
MW-5-DG	25	40	5	37				
MW-5-SB	25	57	5	54	40	C	Yes	
MW-6-SG	20	27	5	24				
MW-6-DG	20	35	5	32				
MW-6-SB	20	51	5	48	38			
MW-6-DB	20	120	5	117	38	C	Yes	Yes
MW-7-SG	25	32	5	29				
MW-7-DG	25	40	5	37		S		
MW-8-SG	25	32	5	29				
MW-8-DG	25	40	5	37		S		
MW-8-SB	25	57	5	54	45			
MW-9-SG	25	32	5	29				
MW-9-DG	25	40	5	37		S		
MW-9-SB	25	57	5	54	45			
MW-10-SG	5	10*	3	9				
MW-11-SG	5	10*	3	9				
MW-12-SG	5	10*	3	9				
MW-13-SG	5	10*	3	9				
MW-14-SG	20	27	5	24				
MW-14-DG	20	35	5	32		S		
MW-14-SB	20	51	5	48	38			
MW-15-SG	25	32	5	29				
MW-15-DG	25	45	5	42		S		
MW-15-SB	25	62	5	59	52			
LF-1	25	30	10	22		C		
LF-2	25	30	10	22		C		
LF-3	25	30	10	22		C		

C = Continuous Split-Spoon Sampling

S = Split-Spoon Sampling At 2.5' Intervals To 10', Every 5' Interval Thereafter

* = Contractor to supply well materials only, no drilling or sampling required.

SG = Shallow Glacial

DG = Deep Glacial

SB - Shallow Bedrock

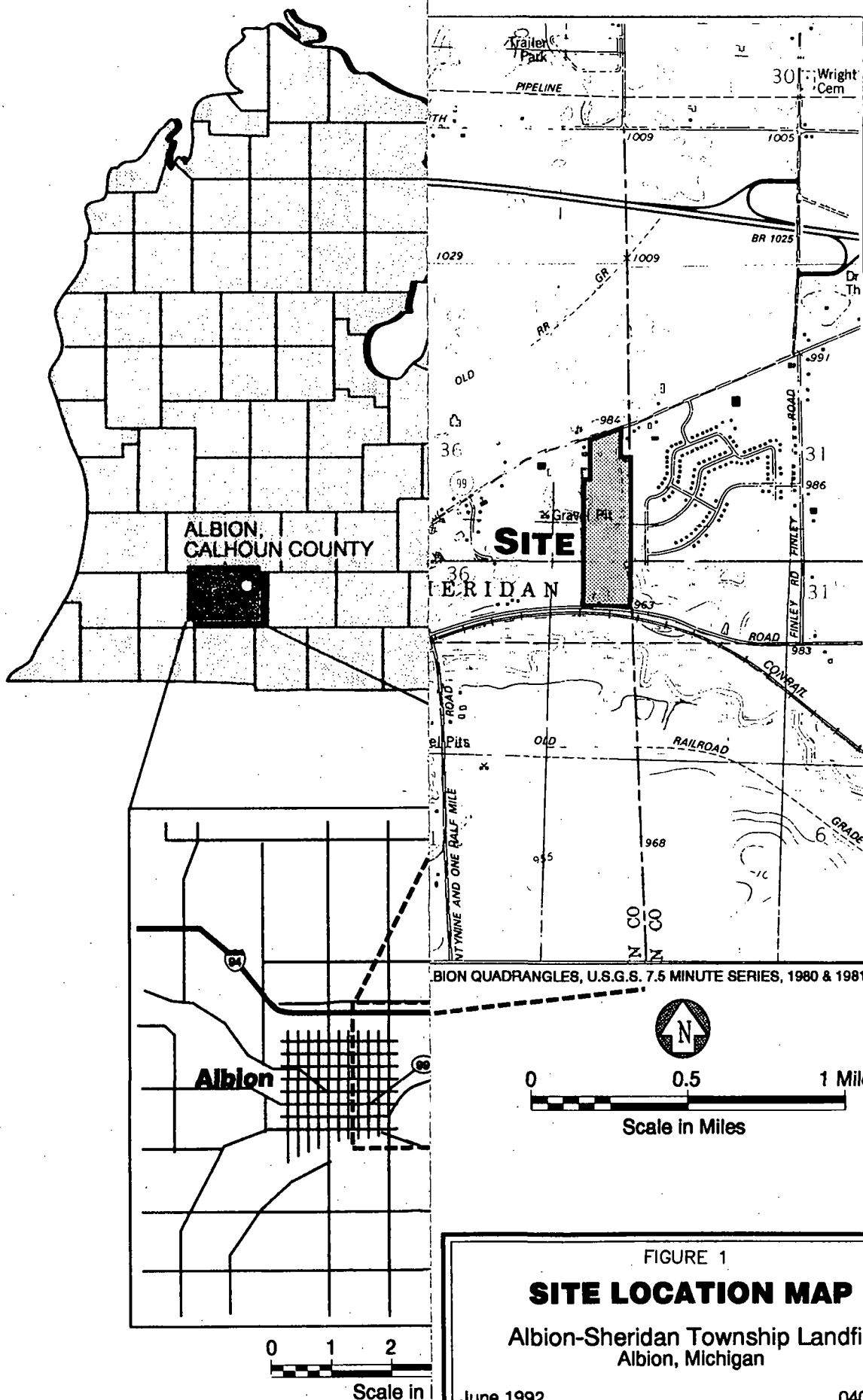
DB - Deep Bedrock

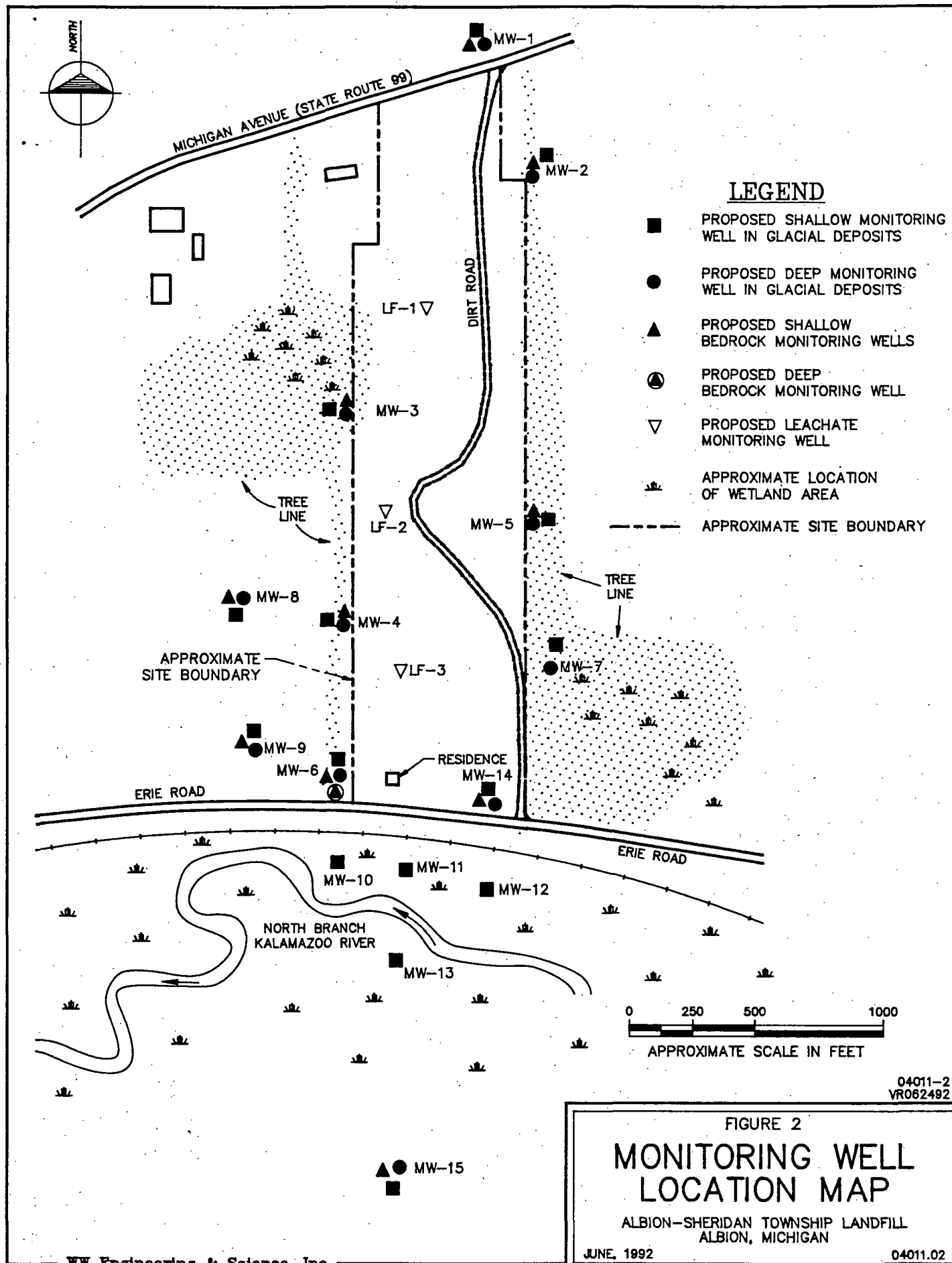
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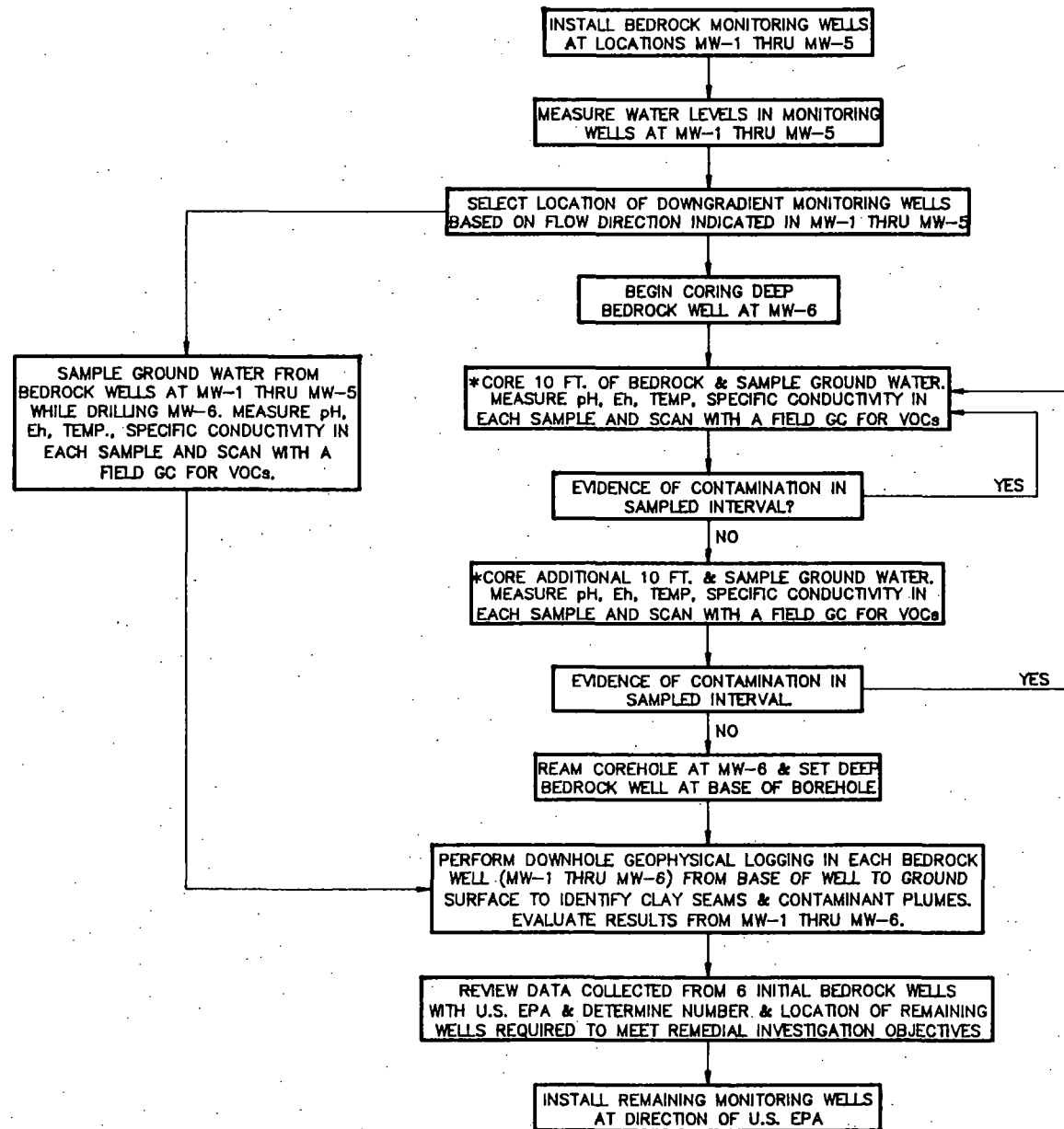
Table 2
Phase II Monitoring Well Summary
Albion - Sheridan Township Landfill
Albion, Michigan
All Units in Feet

Soil Boring/Well Number	Estimated Depth to Water	Estimated Depth to Base of Screen/Boring	Screen Length	Estimated Length of 2" PVC Casing	Estimated Length of 6" PVC Casing
1-DG	25	40	5	37	
2-DG	25	40	5	37	
3-DG	25	40	5	37	
4-DG	25	40	5	37	
5-DG	25	40	5	37	
6-SB	25	57	5	54	40
7-SB	25	57	5	54	40
8-SB	25	57	5	54	40
9-SB	25	57	5	54	40
10-SB	25	57	5	54	40
11-DB	25	120	5	117	40
12-DB	25	120	5	117	40

DG = Deep Glacial
SB = Shallow Bedrock
DB = Deep Bedrock







* NOTE: MAXIMUM DEPTH OF MW-6 IS 120 FEET.

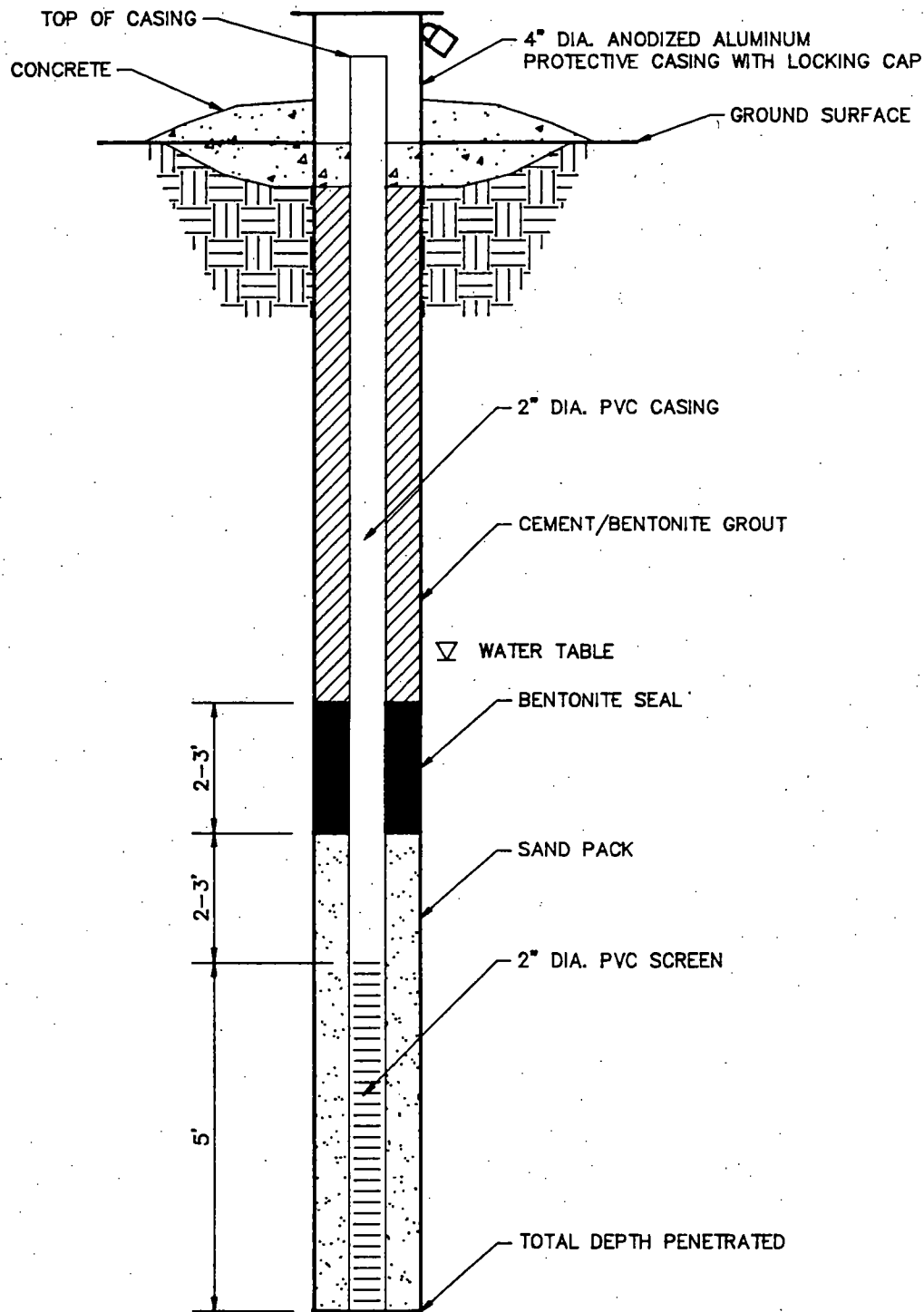
04011-3
VR062292

FIGURE 3
**FLOW CHART FOR
BEDROCK MONITORING
WELL INSTALLATION**

ALBION-SHERIDAN TOWNSHIP LANDFILL
ALBION, MICHIGAN

JUNE, 1992

04011.02



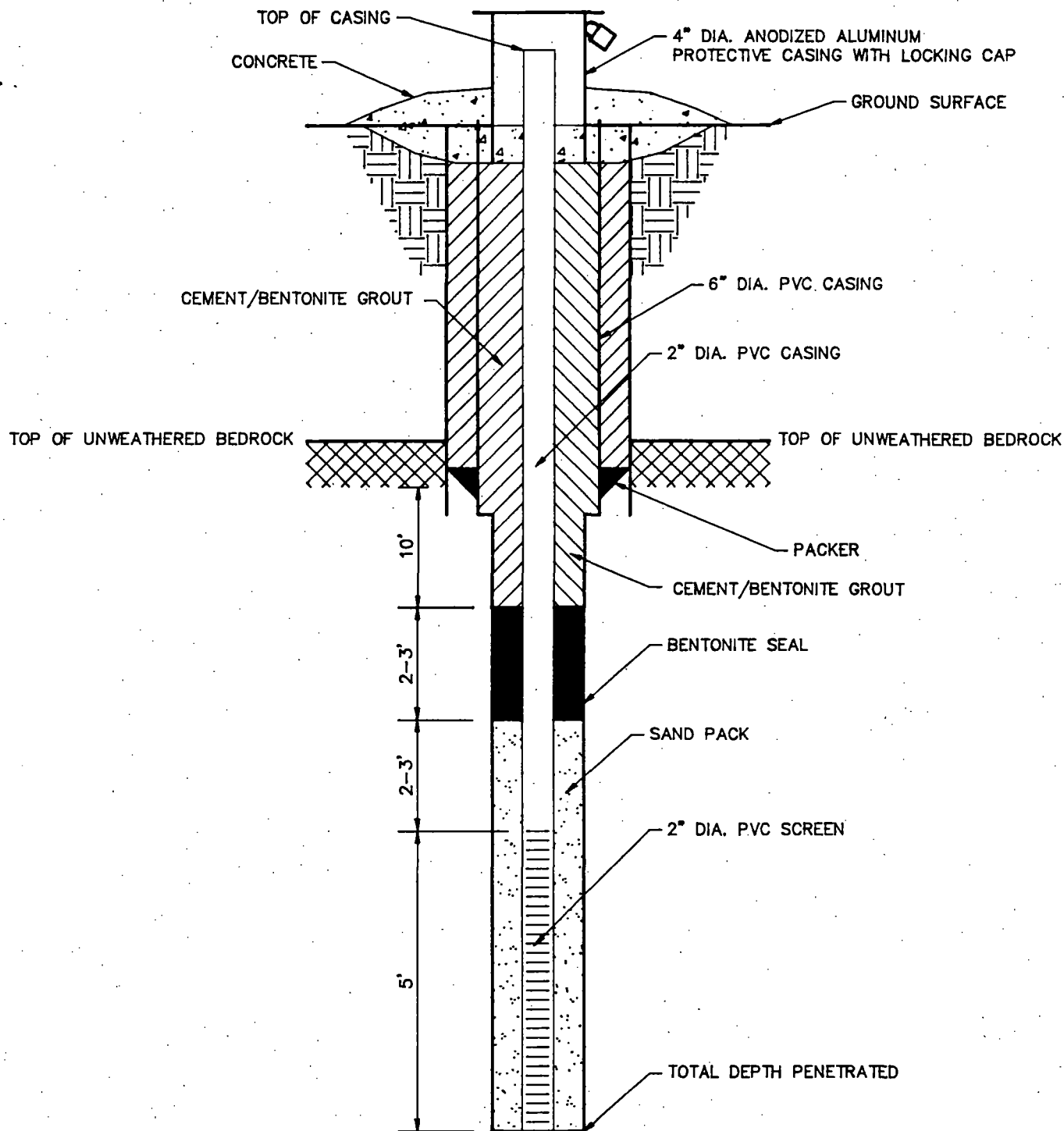
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FIGURE 4
**SCHEMATIC OF MONITORING
WELL CONSTRUCTION IN
GLACIAL DEPOSITS**

ALBION-SHERIDAN TOWNSHIP LANDFILL
ALBION, MICHIGAN

JUNE, 1992

04011.02



04011-5
VR062492

FIGURE 5
**SCHEMATIC OF MONITORING
WELL CONSTRUCTION IN
BEDROCK**

ALBION-SHERIDAN TOWNSHIP LANDFILL
ALBION, MICHIGAN

JUNE, 1992

04011.02